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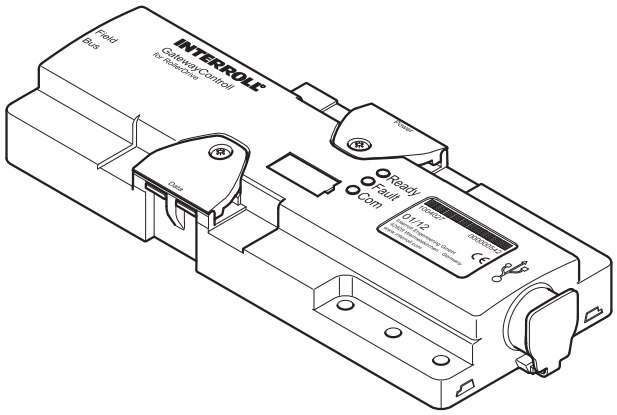

User manual

Interroll GatewayControl

Profibus

Profinet

EtherNet/IP

(addendum to the operating instructions of ConveyorControl)

Version 1.0 (04/2014) en
Translation of the original instructions

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Version 1.0 (04/2014) en
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Introduction

Information about the manual

Contents

These operating instructions contain important notes and information about the following topics:

- Connection of GatewayControl
- Data and error transmission

Details about transport, planning, assembly, commissioning, maintenance and cleaning are located in the operating instructions of the ConveyorControl system.

Other applicable documents:

These operating instructions are valid only in conjunction with the following documents:

- ConveyorControl system operating instructions

Validity of the manual

The manual describes the GatewayControl as it is delivered by Interroll.

In addition to this manual, special contractual agreements and technical documents apply to special versions.

The manual is part of the product

- ➢ For trouble-free, safe operation and warranty claims, read the manual and follow the instructions before handling the GatewayControl.
- ➢ Keep the manual near to the GatewayControl.
- ➢ Pass the manual on to any subsequent operator or occupant of the GatewayControl.
- ➢ Interroll does not accept any liability for faults or defects due to non-observance of this manual.
- ➢ If you have any questions after reading the operation manual, feel free to contact our customer service. Contact persons close to you can be found on the Internet under www.interroll.com/contacts.

Warnings in this manual

The warnings in this document refer to risks which may arise while using the GatewayControl. For relevant warnings, *see "Safety", page 5* and the warnings at the beginning of each chapter.

There are three categories of danger. The following signal words are used in the document as required:

- Danger
- Warning
- Caution

Signal word	Meaning
Danger	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
Warning	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
Caution	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

Structure of warnings

⚠ DANGER

Nature and source of the hazard
Possible consequence of non-observance

➢ Information about how to avoid the hazard.

Further symbols

NOTICE

This symbol identifies possible material damage.
➢ Information about how to avoid the damage.

This symbol displays safety instructions.

This symbol marks useful and important information.

➢ This symbol marks the steps that have to be carried out.
Italics designate a term from the software interface.

Safety

General safety instructions

The GatewayControl has been built to comply with the state of the art and is operationally safe in its delivered state. Nevertheless, users may encounter hazards during use:

- Risks of physical injury to the user or bystanders
- Adverse effects of the GatewayControl and other material.

Disregarding the warning notices in this manual may lead to serious injury.

- ➢ Always read the entire operating and safety instructions before starting to work with the GatewayControl and follow the information contained therein in full.
- ➢ Only instructed and qualified persons may work with the GatewayControl.
- ➢ Always keep the user manual at hand when working at the GatewayControl so you can consult it quickly if required.
- ➢ Always comply with relevant national safety regulations.
- ➢ If you have any questions after reading the operation manual, feel free to contact our customer service. See the last page for your local contact information.

Intended use

The GatewayControl may only be used for industrial applications and in an industrial environment to control the RollerDrive EC310.

The GatewayControl must be integrated into a conveyor module or conveyor system. Any other use is considered inappropriate.

Any modifications that affect the safety of the product are not permitted.

The GatewayControl may only be operated within the defined operating limits.

Unintended use

Use for anything other than the intended purpose requires approval by Interroll.

Qualified persons

Qualified persons are persons who read and understand the manual and, taking national regulations into account, can competently execute incidental work.

Only trained and qualified persons may work with the ConveyorControl system, taking the following into account:

- the relevant manuals and diagrams,
- the warning and safety instructions in this manual,
- the system specific regulations and requirements,
- national or local regulations and requirements for safety and accident prevention.

Dangers

The following list provides information about the various types of danger or damage that may occur while working with the GatewayControl.

Bodily injury

- Maintenance or repair work must only be performed by authorized and qualified persons in accordance with the applicable regulations.
- Before using the GatewayControl, ensure that no unauthorized persons are near the conveyor.

Electricity

- Only perform installation and maintenance work after you have switched off the power.
- Ensure that the power cannot be turned on accidentally.

Working environment

- Do not use the GatewayControl in areas where there is a hazard of explosion.
- Remove equipment or material which is not required from the workspace.

Faults during operation

- Regularly inspect the ConveyorControl components for visible damage.
- If you notice smoke, switch off the power immediately and ensure that it cannot be switched on again accidentally.
- Contact qualified personnel immediately to find the source of the fault.

Maintenance

- Because the product does not require maintenance, you only need to inspect the ConveyorControl components regularly for visible damage and that all cables and screws are firmly in place.

Accidental motor starts

- Exercise caution when installing or performing maintenance on the ConveyorControl components and when troubleshooting, as a start signal may accidentally be triggered, unintentionally starting one of the connected motors.

Interfaces to other devices

When assembling the ConveyorControl components in a conveyor, further hazards may occur. These hazards are not part of this manual and have to be analyzed during the design, installation and startup of the conveyor.

- After assembling the GatewayControl in a conveyor, check the whole system for new potential dangerous spots before switching on.

Operating modes

Normal mode Operation following installation at the user's premises as control components in a conveyor in a complete system.

Special mode All operating modes which are required to guarantee and maintain safe and normal operation.

Special operating mode	Explanation	Comment
Transport/Storage	Loading and unloading, transport and storage	-
Assembly/Initial start-up	Installation at the end customer's and performing the test run	When de-energized
Cleaning	External cleaning	When de-energized
Maintenance/Repairs	Maintenance and inspection tasks	When de-energized
Troubleshooting	Troubleshooting in the event of a fault	When de-energized
Fault elimination	Eliminating the fault	When de-energized
Shut-down	Dismantling from the conveyor	When de-energized
Disposal	Disposal of ConveyorControl system and packaging	-

Product information

Product description

The GatewayControl is part of the ConveyorControl system and represents an alternative to the CentralControl. It allows connecting the system to Profibus, Profinet or EtherNet/IP.

The ConveyorControl system consists of the following additional components:
- SegmentControl
- ComControl
- Configurator
- Accessories

Details about the additional components are located in the operating instructions of the ConveyorControl system.

GatewayControl

The GatewayControl monitors the correct connection and functioning of the individual ConveyorControl modules. It is connected via the bus communication with these modules and can thus recognize and assess various system fault types. The GatewayControl is connected to a master control (PLC) via Profibus, Profinet or EtherNet/IP. It is implemented as IO adapter (slave) and supports implicit (cyclical) and explicit (acyclical) data exchange.

Tasks of the GatewayControl at a glance:
- Manage the ConveyorControl system with a maximum of 200 zones and control their communication
- Control central functions such as *Empty conveyor* or *Reversal of direction*
- Address and parameterize SegmentControl and ComControl
- Monitor the ConveyorControl system
- Form interface to PLC via Profibus, Profinet or EtherNet/IP

The GatewayControl must be connected to one end of the bus line. It features a terminating resistor which is required for the bus line. A ComControl with activated terminating resistor must be connected to the other end of the bus line.

Control modes

A GatewayControl can be operated in two different control modes:
- **I/O PLC control**: In this control mode, SegmentControls and ComControls control the conveying process. The master PLC can monitor and influence the conveying process using the process map for individual zones or the entire conveyor (start, stop, reversal of direction).
- **Full PLC control**: In this control mode, the master PLC controls the conveying process. The process map of the PLC shows the current states of the sensors and the RollerDrive and individual RollerDrives can be switched on or off. In this control mode, the ConveyorControl system does not offer a zero pressure accumulation control logic, which must be programmed via the PLC.

Web server

The GatewayControl for EtherNet/IP and for Profinet contains a web server which can be used to perform software updates. The Internet or intranet access to the device made possible via the integrated web server also comes with the risk of abuse. Access to the web server is secured with a user ID and a password.

Profibus

Topic	Description
Transmission technology	RS 485 acc. to ANSI TIA/EIA 485-A
Bit rates	9.6 kbit – 12 Mbit, automatic bit rate recognition is recommended
Protocol	Profibus DP with DPV1 expansion
Node class	DPV1 slave
Node configuration	Modular slave with 11 fixed assigned modules
Transmission service	MSO for cyclical data: 202 byte input data 202 byte output data FAILSAFE function supported SYNC and FREEZE mode not supported
	MS1/MS2 for acyclical data I&M0 (65000): Device-specific basic information Read fault status and conveying parameters Write conveying parameters Diagnostics alarms

Profinet

Topic	Description
Transmission technology	100BASE-TX, full duplex
Bit rate	100 Mbit/s
Protocol	Profinet IO, PN-RT_CLASS_1
Node class	I/O device
Node configuration	Modular slave with 11 fixed assigned modules
Transmission service	IO Data CRt for cyclical data: 202 byte input data 202 byte output data FAILSAFE function supported SYNC and FREEZE mode not supported
	Record Data CR for acyclical data: I&M0 (65000): Device-specific basic information Read fault status and conveying parameters Write conveying parameters
	Alarm CR for acyclical alarm data: Diagnostics alarms

I&M (Identification and Maintenance) for Profibus/ Profinet

The GatewayControl supports I&M data level 0. This data will allow the identification of the device via Profibus.

The following information is transmitted:

- Name of manufacturer
- Vendor ID
- Order ID
- Serial number of device
- Hardware and software version
- Product type (in form of 2 profile IDs)

Diagnostics and alarms for Profibus/Profinet

The GatewayControl provides an expanded diagnostics according to the Profibus/Profinet standard.

The manufacturer-specific diagnostics data consist of 4 bytes with the following content:

- 2 bytes, global error register (ERR)
- 2 bytes, extended error register (ERR_EXT)

The content of the ERR and ERR_EXT register is described in (*see "Error status and setting values", page 33*).

The slot assignment for the data modules is described in appendix D (*see page 42*).

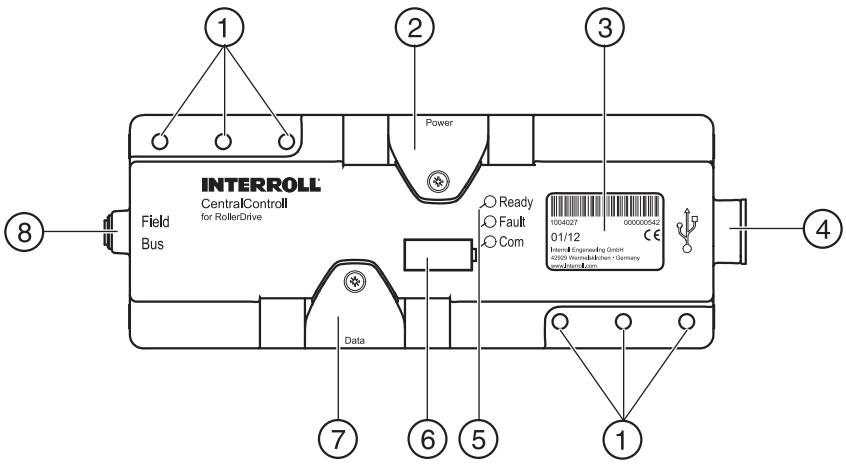
Ethernet

Topic	Description
Transmission technology	100BASE-TX, full duplex
Bit rate	10/100 Mbit/s
Protocol	CIP
Node class	Communications adapter
Transmission service	Implicit messages for cyclical data: 202 byte input data 202 byte output data
	Explicit messages for acyclical data: Device-specific basic information Read fault status and conveying parameters Write conveying parameters
Additional services	UCMM, ACD. BOOTP. DHCP

Data management for EtherNet/IP is done via communication objects. Appendix C contains the description of the objects used by the GatewayControl (*see page 36*).

The data format is specified as Little-Endian, i. e. the lowest-value bytes of numeric values are transmitted first.

Structure



① Mounting holes
② Power supply connection
③ Label
④ USB connection
⑤ LEDs
⑥ Marker (changeable)
⑦ Bus communication connection
⑧ Profibus, Profinet or EtherNet/IP connection

Scope of supply

The scope of supply of the GatewayControl contains the following components:

- GatewayControl
- 2 end caps to terminate the flat cable - left design
- 2 end caps to terminate the flat cable - right design
- USB stick with ConveyorControl Configurator software
- Addressing magnet

Label

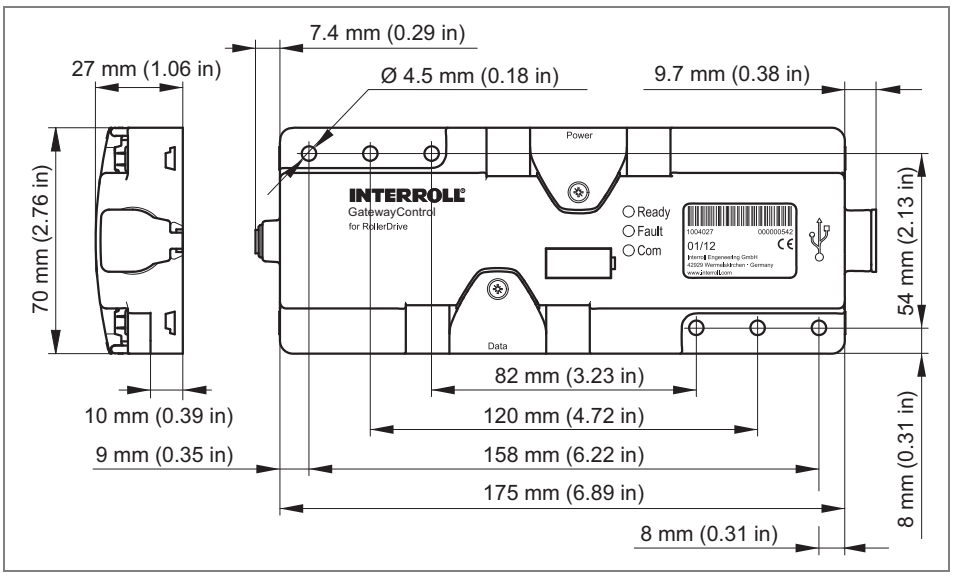
The information on the label is used to identify the GatewayControl.

① Manufacturer
② Week and year of production
③ Article number
④ Serial number

Technical data

Rated voltage	24 V DC
Voltage range	19 to 26 V DC
Current consumption	100 mA
Protection classification	IP54
Weight	approx. 370 g (13 oz)
Ambient temperature in operation	-28 °C to +40 °C (-18 °F to +104 °F)
Temperature change	1 K/min, 3 h (two cycles in acc. with IEC 68-2-14)
Air humidity	max. 93% at 40 °C (104 °F), 14 day, non-condensing (IEC 68-2-78, DIN EN 60068-2-78)
Installation height above sea level	max. 3000 m (max. 9800 ft)
Mechanical stress	IEC 60068-2-27 15 g / 6 ms; 10 g / 11 ms EC 60068-2-6 2-500 Hz ±1.6 mm / 2 g IEC 60068-2-64 2-500 Hz ±1.6 mm / 2 g

Dimensions


7.4 mm (0.29 in)
27 mm (1.06 in)
Ø 4.5 mm (0.18 in)
9.7 mm (0.38 in)
70 mm (2.76 in)
54 mm (2.13 in)
Power
INTERROLL
GatewayControl
for RollerDrive
Ready
Fault
Com
01/12
Data
82 mm (3.23 in)
10 mm (0.39 in)
120 mm (4.72 in)
9 mm (0.35 in)
158 mm (6.22 in)
175 mm (6.89 in)
8 mm (0.31 in)
8 mm (0.31 in)

Transport and storage

Details about the transport and storage are located in the operating instructions of the ConveyorControl system.

Planning

The planning of a ConveyorControl system with GatewayControl is done with the ConveyorControl Configurator (henceforth referred to solely as Configurator). All the module parameters can be set offline and then downloaded collectively to the ConveyorControl modules.

The following steps are required for this purpose:

- **Map**: Map the zones of the conveyor path and all ConveyorControl modules with the Configurator
- **Prepare to address**: The assignment of a unique address for each module is being prepared
- **Address**: Assign modules a unique address suing the addressing magnet
- **Parameterize**: Define settings for each module
- **Download**: Parameters are downloaded to the modules

Details about the Configurator and planning the conveying path with all ConveyorControl modules are located in the operating instructions of the ConveyorControl system.

This chapter contains notes about the parameterization of the GatewayControl.

Parameterizing the GatewayControl

In this step, the settings for the GatewayControl can be defined. They only take effect once they have been downloaded to the module.

Requirement: The conveying path was completely mapped in the Configurator (see operating instructions of the ConveyorControl system).

➢ In the work step bar, click on the *Parameterize* button.
➢ Select GatewayControl.
➢ Click on the value of the *Control mode* parameter and select *I/O PLC control* or *Full PLC control*.
➢ Change the parameters according to the requirements.

Profibus GatewayControl This tab includes the parameters for defining the functions of the Profibus GatewayControl.

ID	Name	Meaning	Value range	Default setting
PB1	BusType	Name of the bus system	Cannot be set	*Profibus*
PB2	BusBitrate	Transfer speed of the Profibus	*Autodetect* *9.6 kbit* *19.2 kbit* *93.75 kbit* *187.5 kbit* *500 kbit* *1.5 Mbit* *12 Mbit*	*Autodetect*
PB3	BusAddress	Profibus node address of GatewayControl		5
PB8	BusErrorResponse	System response in case of faults	*LED display* *System error* *System stops*	*System stops*
PG1	*ControlMode*	Control operating mode of the ConveyorControl system	*I/O PLC control* *Complete PLC control*	*I/O PLC control*
	ProductKey	Article number of the module	Cannot be set	–
	Serial	Serial number of the module	Cannot be set	–

Profinet GatewayControl This tab includes the parameters for defining the functions of the Profinet GatewayControl.

ID	Name	Meaning	Value range	Default setting
PB1	*BusType*	Name of the bus system	Cannot be set	*Profinet*
PB4	*HostName*	Name of GatewayControl in the network		*gateway*
PB5	*IPAddress*	Internet protocol address of GatewayControl in the network		*0.0.0.0*
PB6	*SubnetMask*	Relevant bits for the network prefix of the Internet protocol address		*0.0.0.0*
PB7	*BroadcastAddress*	Broadcast address of GatewayControl		*0.0.0.0*
PB8	*BusErrorResponse*	System response in case of faults	*LED display* *System error* *System stops*	*System stops*
PG1	*ControlMode*	Control mode	*I/O PLC control* *Complete PLC control*	*I/O PLC control.*
	ProductKey	Article number of the module	Cannot be set	–
	Serial	Serial number of the module	Cannot be set	–

EtherNet/IP GatewayControl This tab includes the parameters for the functions of EtherNet/IP GatewayControl.

ID	Name	Meaning	Value range	Default setting
PB1	*BusType*	Name of the bus system	Cannot be set	*Ethernet*
PB4	*HostName*	Name of GatewayControl in the network		*gateway*
PB5	*IPAddress*	Internet protocol address of GatewayControl in the network		*0.0.0.0*
PB6	*SubnetMask*	Relevant bits for the network prefix of the Internet protocol address		*0.0.0.0*
PB7	*BroadcastAddress*	Broadcast address of GatewayControl		*0.0.0.0*
PB8	*BusErrorResponse*	System response in case of faults	*LED display* *System error* *System stops*	*System stops*
PB10	*DomainName*	Domain name of GatewayControl		
PB11	*DNS ServerAddress*	IP address of the responsible primary DNS server		*0.0.0.0*
PB12	*DNS ServerAddress2*	IP address of alternative DNS server		*0.0.0.0*
PB13	*NetworkConfigMode*	Network settings	*Static* *BootP* *DHCP*	*DHCP*
PB14	*PortSettings*	Operating mode and transfer speed of Ethernet port	*Half duplex 10 Mbps* *Full duplex 10 Mbps* *Half duplex 100 Mbps* *Full duplex 100 Mbps* *Auto*	*Auto*
PG1	*ControlMode*	Control mode	*I/O PLC control* *Complete PLC control*	*I/O PLC control.*
	ProductKey	Article number of the module	Cannot be set	–
	Serial	Serial number of the module	Cannot be set	–
	MACAddress	Ethernet hardware address of GatewayControl	Cannot be set	–

For a more detailed description of the parameters, *see "Appendix G – Glossary of Parameters", page 49*.

Assembly

Warning information for assembly

NOTICE

Risk of damage leading to failure or shortened life expectancy

- Check each GatewayControl module visually for damage before assembly.
- Make sure that these modules are not warped during installation (no bending or torsion).
- Do not drill additional mounting holes in the casing or enlarge the holes provided.
- Do not drop the modules to prevent internal damage.

Assembly of the GatewayControl

For notes about the assembly, see the operating instructions of the ConveyorControl system.

Warning notices concerning the electrical installation

NOTICE

Damage to ConveyorControl modules

- Observe the following safety information.

- Electrical work should only be performed by qualified and authorized persons. Protection rating IP54 is only achieved with correct installation.
- Disconnect the power supply before installing, removing or rewiring the ConveyorControl modules.
- Ensure that no hazardous voltage can come into contact with the connections or the housing, not even in the event of a malfunction or fault.
- ConveyorControlmodules are never to be operated with AC current as this will cause irreparable damage.
- Do not use earth connections or earth wires as a protective conductor (PE).
- Do not apply too much tension or load to the plug. The cable insulation can become damaged if the cable is bent at the plug and the ConveyorControl modules or the RollerDrive could fail.
- Only use cables that are dimensioned sufficiently for the application.
- Ensure that the switching power supply unit supplying the ConveyorControl system supplies a nominal DC voltage of 24 V with a maximum deviation of ±8 %.
- Ensure that the RollerDrive and the voltage source are connected to the conveyor frame or supporting structure in such a way that they are properly earthed. Incorrect earthing can result in the build-up of static charge, causing the RollerDrive or the ConveyorControl modules to malfunction or fail prematurely.
- Use suitable switching equipment to ensure safe operation.
- Only apply operating voltage when all of the cables have been connected.

NOTICE

Damage to the flat cable following incorrect wiring

- Do not bend the flat cable on the narrow side.
- When bending on the broad side, ensure a minimum bending radius of 12 mm / 0.5 in (when in a fixed installation) or 30 mm / 1,2 in (at moving points and during storage and transportation).
- When laying and when in a fixed installation ensure that the flat cable is not subject to tensile stress.
- Avoid excessive vibrations, unsupported free-hanging cable, bending and crushing.

Electrical installation

For general notes about the installation of GatewayControl, see the operating instructions of the ConveyorControl system.

Overview of connections

The GatewayControl features the following connections:

Connection	Signal/components	Contacting	Type
Power	Power supply	Flat cable via pin	IN
Data	Bus communication	Flat cable via pin	IN/OUT
USB	USB 2.0	USB Mini-B, 5-pin	IN/OUT
Field Bus	Profibus Profinet or EtherNet/IP	M12, 5-pin, B-coded acc. to IEC61076-2-101 M12, 4-pin, D-coded acc. to IEC61076-2-101	IN/OUT

USB port

The GatewayControl features a USB mini B port to connect it to a laptop and to transfer the data of the Configurator.

- ➢ Pull off the protective black cap. Do not tear. The tab will prevent loss.
- ➢ Connect the USB plug.
- ➢ When the USB connection is no longer required, remove the USB cable and reattach the protective cap to achieve protection rating IP54.

Fieldbus termination

The termination of the fieldbus is required for Profibus only. If the GatewayControl should be the last node of a Profibus line, two termination variants are possible depending on the line length between the next-to-last node and the GatewayControl:

- Termination in the Sub-D plug of the next-to-last node (if the line between Sub-D socket of the next-to-last node and GatewayControl is shorter than 50 cm / 19.7 inch):
  Required material:
  – M12 Profibus cable with one plug (other end is open), e. g. SAC-2P-1,0-910/M12FSB - bus system cable
  – Sub-D connector with switchable terminating resistor, e. g. SUBCON PLUS Profibus connector up to 12 Mbit/s
- Termination at the GatewayControl (if the line between Sub-D socket of the last node and GatewayControl is longer than 50 cm / 19.7 inch)
  Required material:
  – M12 T or Y splitter
  – I-Net Profibus M12 terminating plug

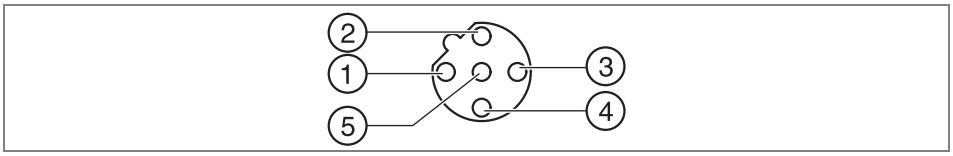
Two variants are available for the transition from Sub-D socket to M12:

- Adapter from 9-pin Sub-D to M12 and also an M12 line with plug/socket
- M12 Profibus cable with one M12 plug and Sub-D connector with switchable terminating resistor

Profibus connection

The GatewayControl is a Profibus DP slave and sends or receives information only if queried by the master PLC. The GatewayControl does not independently communicate with other devices.

The M12 connection is B-coded according to IEC 61076-2-101.

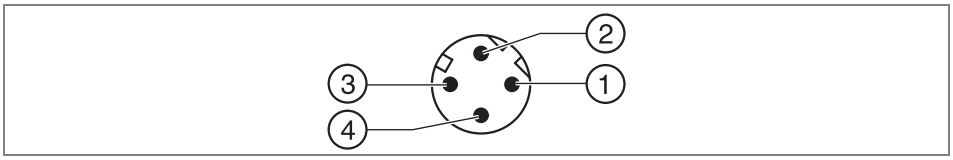


PIN	Signal	Function	Type
1	VP	+5 V supply for bus termination	Mandatory
2	RxD/TxD-N	Minus data line (A line)	Mandatory
3	DGND	Data ground	Mandatory
4	RxD/TxD-P	Plus data line (B line)	Mandatory
5	—	not occupied	
Thread	Shield	Ground connection	Recommended

Profinet/Ethernet/IP connection

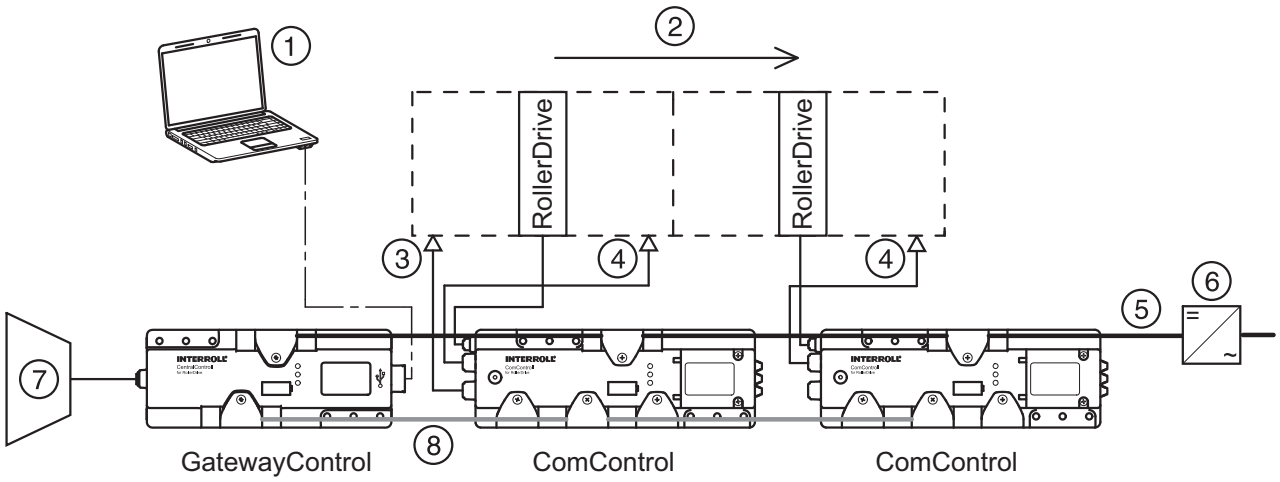
The GatewayControl is a Profinet I/O device and sends or receives information only if queried by the master PLC. The GatewayControl does not independently communicate with other devices.

The M12 connection is D-coded according to IEC 61076-2-101.



PIN	Signal	Name
1	TD+	Transmission Data +
2	RD+	Receive Data +
3	TD-	Transmission Data -
4	RD-	Receive Data -

Example of connection



① PC
② Direction of travel
③ Start sensor
④ Zone sensor
⑤ Flat cable voltage supply
⑥ Power supply unit
⑦ PLC
⑧ Flat cable bus communication

A 2-zone conveyor is shown. Each zone is driven by an Interroll RollerDrive and monitored by a zone sensor. At the start of the conveyor, a start sensor monitors whether conveying material reaches the conveyor. The drives and sensors are connected directly to the ComControl. The modules communicate with each other via the lower flat cable. The power supply unit supplies the ComControl and the GatewayControl with voltage. The sensors and drives are supplied with voltage via the ComControl. The wiring of power supply unit and modules is also done using a flat cable. A PC is connected with a USB cable for addressing the two ComControls and for parameterizing the system. The Configurator is installed on the PC with which the system can be addressed and parameterized. After these two steps, the PC and the USB cable can be removed.

Initial startup and operation

Initial startup

Checks before initial startup

- Ensure that all ConveyorControl modules have been correctly fastened to the profile and that all screws have been correctly tightened.
- Ensure that there are no additional areas of danger caused by interfaces to other components.
- Ensure that the wiring is in accordance with the specification and legal directives.
- Check all protection devices.
- Ensure there are no bystanders in dangerous areas around the conveyor.

Pre-commissioning checks

- Check all ConveyorControl modules for visible damage.
- Check all protection devices.
- Ensure that no RollerDrive is blocked.
- Clearly specify and monitor the way goods are placed on the conveyor.
- Ensure there are no bystanders in dangerous areas around the conveyor.

Parameterizing the GatewayControl

Below is a description of only the steps required for parameterizing the GatewayControl. All other details for commissioning and operation of the complete system are located in the operating instructions of the ConveyorControl system.

- Using the USB cable, connect the computer with the GatewayControl.
- Map the ConveyorControl system. In the process, select the type of GatewayControl (Profibus, Profinet or EtherNet/IP).
- Prepare the addressing.

The GatewayControl is set to node ID 1 at the factory. It cannot be changed in the context of the addressing procedure required for the other modules or assigned to another module.

- Address the ConveyorControl system.
- Download the parameters.
- De-energize all ConveyorControl components, insert the fieldbus cable in connector M12 and secure it with the coupling ring.
- Switch the supply voltage on again.
  After a maximum of 20 seconds, the control connects with the GatewayControl.

Operation

Details about the operation are located in the operating instructions of the ConveyorControl system.

Maintenance and cleaning

Details about the maintenance and cleaning are located in the operating instructions of the ConveyorControl system.

Troubleshooting

Meaning of the LEDs

LEDs on the GatewayControl report the operating state of the ConveyorControl system.

The following LEDs are available:
- Ready (green)
- Fault (red)
- Com (green)

Status descriptions of the LEDs:
- Off: LED is statically off
- On: LED is statically on
- Flashes 1 Hz: LED flashes at a frequency of 1 Hz; pulse duty factor 1:1
- Flashes 2 Hz: LED flashes at a frequency of 2 Hz; pulse duty factor 1:1
- Flashes: LED flashes 1 to 6 times (depending on error) within 3 seconds for 250 ms in each case. The error type can be determined based on the number of flashes (*see "Error signaling", page 26*)
- X: LED status variable, depending on system status and LED function (see Comments in the table)

In any status, the 'Com' LED signals communication on the CAN bus by flashing or flickering.

The status of the 'Ready' LED signals the status of the conveyor:
- Flashing: Initializing the system or not in conveying mode
- On: System in conveying mode

LED status displays

LED Ready	LED Fault	LED Com	Meaning
Generally			
Off	Off	Off	No operating voltage
Operating states			
Flashes 2 Hz	Off	X	The GatewayControl initializes its own hardware, the internal or external bus
Flashes 1 Hz	Off	X	The GatewayControl starts and checks the network. System is not in conveying mode.
On	Off	X	The GatewayControl successfully switched the system to conveying mode. No error occurred.
Conditions after occurrence of errors			
Flashes 2 Hz	Flashes 6x	X	An error occurred while initializing the internal hardware in the GatewayControl or while initializing the internal or external bus.
Flashes 2 Hz	Flashes 2x	X	System is not in conveying mode. System is started as soon as the communication with the PLC has been established.
On	Flashes 1x	X	System is in conveying mode. The reported error is not a system error.
On	Flashes 2x	X	System is in conveying mode. There is no connection to the PLC or it is in error mode.

LED Ready	LED Fault	LED Com	Meaning
Off	Flashes 4x	X	The GatewayControl detected a critical system error in the voltage level. The system was stopped due to a critical error.
Off	Flashes 6x	X	The system was stopped due to a critical error and is not in conveying mode.

Error signaling

The error type can be determined by the number of flashes of the Fault LED (in a 3-second interval):

Number of flashes	Error	Comment
1	Non-critical error within the ConveyorControl system	
2	No connection to PLC	System cannot be started or is being stopped. After solving the error, the system can be restarted.
4	Voltage error at the GatewayControl	System is stopped due to the voltage error. A voltage reset must be performed (same as system error).
6	The GatewayControl detected a system error	System is stopped due to the system error. A voltage reset must be performed.

Behavior in case of an error

Occurring errors are distinguished in 2 categories: Status errors and system errors.

If errors occurred in the system (status errors or system errors), the control can query the current error status from zones or the GatewayControl itself (zone address = 0) by querying the error register (ERR) via acyclical accesses.

Status error

Status errors are non-critical errors of nodes in the ConveyorControl system. They can potentially limit the operation of the system, but they do not cause the system to be switched out of conveying mode. This includes all the errors that are not parameterized or defined as system errors for the respective node, such as logic errors, sensor errors or RollerDrive errors.nbsp

When status errors occur, the error bit in the zone process data (LSCR) of the respective control module is set to signal the presence of an error for this zone. Depending on the control variant (*Full PLC control* or *I/O PLC control*), additional error bits are set in the zone process data (LSCR) of the pertinent zone that can already specify the error in more detail. In addition, the error bit is set in the global status register of the system (GSCR). This register should represent the first starting point when checking for errors since it reflects the summary status of errors in the GRC system.

An additional notification to the master control does not take place. That is, the control must cyclically analyze the status register of the system (GSCR) to determine existing status errors.

System error

System errors are critical errors by nodes in the ConveyorControl system, including the GatewayControl itself. This includes all the errors that are parameterized or defined as system error for the respective node (e.g. voltage errors, temperature errors, communication errors or similar). These errors cause the system to be switched out of conveying mode to ensure system safety. Acyclical services are still possible if the cause was not a failure of communication to the master control.

When system errors occur, the error bit in the zone process data (LSCR) of the respective control module is set to signal the presence of an error for this zone. In addition, the error bit is set in the global status register of the system (GSCR). Since system errors are potentially critical errors that could place the system integrity at risk, the system is switched out of conveying mode and stopped. The exchange of cyclical zone process data is no longer possible on the bus. That means, whenever system errors occur, the cyclical process data (except for error bits) must be evaluated as invalid! Acyclical services are still possible if the cause was not a failure of communication to the master control.

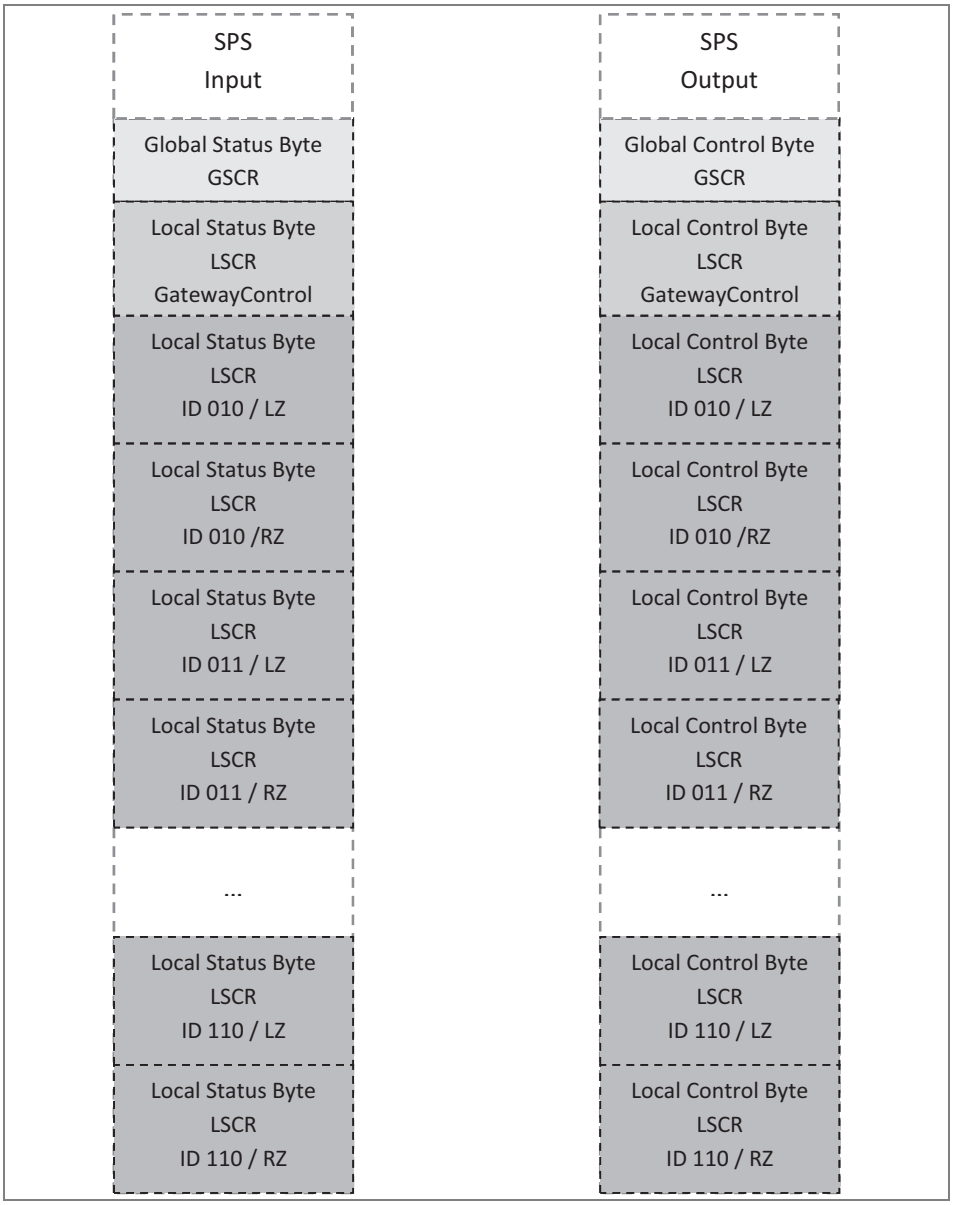
When system errors occur, the GatewayControl transmits a diagnostics alarm to the master control for Profibus or Profinet fieldbus. The diagnostics alarm must have been activated earlier during project planning. An acknowledgment of the alarm by the control is not required. The cause of the occurring error is specified in more detail in the data for the diagnostics alarm. The useful data content of the diagnostics alarm consists of 4 bytes of manufacturer-specific data, identical to the expanded diagnostics, that provide information about the cause of the system error. Once a diagnostics alarm has been reported, it is no longer reset by the GatewayControl since system errors can be reset only by a voltage reset.

Decommissioning and disposal

Details about the decommissioning and disposal are located in the operating instructions of the ConveyorControl system.

Appendix A – PLC Process Map – Cyclical Data

The process data pool contains one Local Status Byte (**LSCR**) per zone (each as input and as output). One LSCR is assigned to the GatewayControl. This results in 201 bytes of IO data for local zone information. One Global Status Byte (**GSCR**) was defined for the global system status or for global control commands. If the data modules are aligned flush in the I/O area of the control for Profibus/ Profinet (slot assignment *see "Appendix D – Slot Assignment for Profibus/ Profinet", page 42*), it results in the following structure of the process map:



In the Configurator, the display can be toggled between user-zone designation and node ID (see operating instructions of the ConveyorControl system).

SegmentControl and ComControl are addressed with a node ID which is assigned by the Configurator during the project planning of the conveyor.

In the previous graphic, *ID 010 / LZ* refers to the left zone of a SegmentControl or the zone of a ComControl with node ID 10. *ID 011 / RZ* indicates the right zone of a SegmentControl with node ID 11. A ComControl uses only the LSCR entry for the left zone. The entry reserved for the right zone for this node ID in the process map is not being used.

From the node ID, the zone address is being calculated:
- For the left zone: Zone address := ((node ID - 10) * 2) + 1
- For the right zone: Zone address := ((node ID - 10) * 2) + 2

The calculated zone address is sued for the zone selection for the acyclical write/ read accesses (error status / setting values of the zones). As an alternative to calculating the zone address, it can also be exported via the Configurator (see operating instructions of the ConveyorControl system). From the zone address, it is also possible to calculate an index in the process map of the GatewayControl which allows reading or writing the zone status and control register.

The index to the process map is calculated as follows:
- Index := (zone address - 1) + 2

And consequently the I/O address for a certain zone of the conveyor:
- I/O address := BaseAddress + Index

LSCR – Local State / Control Register for the control mode *I/O PLC control*

Bit position	7	6	5	4	3	2	1	0
Acronym	**ERR**	**LSTA**	**ISTA**	**LSTP**	**ISTP**	**ZS**	**RDS**	**ZSS**
Read/Write	R	R/W	R/W	R/W	R/W	R	R	R
Description	Zone Error	Start Z one zone	Start D one zone	Stop Z one zone	Stop D one zone	Zone transport state	RollerDrive state	Zone sensor state
Bit Low	No error	de-active	de-active	de-active	de-active	Zone free	RollerDrive stopped	No object detected
Bit High	Error	active	active	active	active	Zone not free	RollerDrive running	Object detected
Comment	Not set, if all error modes configured to 'ignore'.	RollerDrive starts with regards to the ZPA logic	RollerDrive starts immediately (regardless of the ZPA logic)	RollerDrive stops if an object is detected by the zone sensor	RollerDrive stops immediately (regardless of the ZPA logic)			

LSCR – Local State/Control Register for the control mode *Full PLC control*

Bit position	7	6	5	4	3	2	1	0
Acronym	**ERR**	**IO3**	**IO2**	**IO1**	**ZSE**	**RDE**	**RDS**	**ZSS**
Read/Write	R	R/W	R/W	R/W	R	R	R/W	R
Description	Zone Error	Digital I/O State In3 / Out3	Digital I/O State In2 (AS) / Out2	Digital I/O State In1 (ZS) / Out1	Zone Sensor error	RollerDrive error	RollerDrive state	Zone sensor state
Bit Low	No error	Not active / Off	Not active / Off	Not active / Off	No error	0 = no error	RollerDrive stopped	No object detected
Bit High	Error	Active / On	Active / On	Active / On	Error	Error	RollerDrive running	Object detected
Comment	Not set, if all error modes configured to 'ignore'.				Not set, if ZS error mode configured to 'ignore'.	Not set, if RollerDrive error mode configured to 'ignore'.		

LSCR – Local State/Control Register for the control mode *Full PLC control* and *I/O PLC control* for the GatewayControl

Bit position	7	6	5	4	3	2	1	0
Acronym	ERR	---	---	---	---	---	---	---
Read/Write	R	---	---	---	---	---	---	---
Description	Master Error	---	---	---	---	---	---	---
Bit Low	No error	---	---	---	---	---	---	---
Bit High	Error	---	---	---	---	---	---	---
Comment		---	---	---	---	---	---	---

GSCR – Global Status / Control Register for the control mode *I/O PLC control*

Bit position	7	6	5	4	3	2	1	0
Acronym	**TDIR**	**SSEL**	**ERRSIG**	**---**	**LSTP**	**ISTP**	**CLRI**	**CLR**
Read/Write	R/W	R/W	R	N/A	R/W	R/W	R/W	R/W
Description	Conveying direction	Speed selection	Error Indication	Not used	Stop Z all zones	Stop D all zones	Clear (empty conveyor) reverse direction	Clear (empty conveyor) normal direction
Bit Low	normal	Main speed	No error	---	de-active	de-active	de-active	de-active
Bit High	inverted	Alternative speed	At least one error somewhere in the system	---	active	active	active	active
Comment			ComControl modules with configured error output will reflect the state of this bit at the corresponding output.	---	All RollerDrives will stop if an object is detected by the corresponding zone sensor	All RollerDrives stop immediately (regardless of the ZPA transport logic)		

GSCR – Global Status / Control Register for the control mode *Full PLC control*

Bit position	7	6	5	4	3	2	1	0
Acronym	**TDIR**	**SSEL**	**ERRSIG**	**---**	**---**	**ISTP**	**CLRI**	**CLR**
Read/Write	R/W	R/W	R	N/A	N/A	R/W	R/W	R/W
Description	Conveying direction	Speed selection	Error Indication	Not used	Not used	Stop D all zones	Clear (empty conveyor) reverse direction	Clear (empty conveyor) normal direction
Bit Low	normal	Main speed	No error	---	---	de-active	de-active	de-active
Bit High	inverted	Alternative speed	At least one error somewhere in the system	---	---	active	active	active
Comment			ComControl modules with configured error output will reflect the state of this bit at the corresponding output.	---	---	All RollerDrives stop immediately (regardless of the ZPA transport logic)		

Appendix B – Setting Values/Errors – Acyclical Process Data

Access to the error status and the setting values of the complete system or individual conveying zones is done via acyclical read and write accesses according to DPV1 Class 1 (Profibus/Profinet) or Explicit Messaging (EtherNet/IP). Device identification and alarms are also transmitted acyclically.

Error status and setting values

For Profibus/Profinet, access is made via the function blocks RDREC or WRREC in accordance with IEC 61131-3. The *ID* parameter must be supplied with the I/O base address of the ConveyorControl module which represents the error status or the desired setting value according to the following table. The *Index* parameter is used to select the desired conveyor zone. A calculation rule exists for the zone number (*see "Appendix A – PLC Process Map – Cyclical Data", page 29*). GatewayControl is addressed with index *0*.

For EtherNet/IP, access is made with the MSG directive, whereby a CIP message of service type GetAttribute_Single or SetAttribute_Single must be used. Details *see "Appendix E – CIP Objects for EtherNet/IP", page 43*.

Setting values that changed compared to the basic configuration are not stored in GatewayControl. They will have to be recopied after a failure of the supply voltage.

Slot no. / Function	Index / Zone address	Access	Description of functions	Data length/data content
6	Zone address 000 - 200	Read	Reading the error register GatewayControl = Index 000	16 bit – see error register definition (ERR)
7	Zone address 001 - 200	Read/ write	Reading/setting the RD direction of rotation	16 bit – 0 = CW, 1 = CCW
8	Zone address 001 - 200	Read/ write	Reading/setting the RD speed as converted value	16 bit – 0..255 speed setpoint
9	Zone address 001 - 200	Read/ write	Reading/setting the alternative RD speed as converted value	16 bit – 0..255 speed setpoint
10	Zone address 001 - 200	Read/ write	Reading/setting the RD acceleration (startup ramp) as converted value	16 bit – HiByte – time unit 0..255 16 bit – LoByte – increment 0..255
11	Zone address 001 - 200	Read/ write	Reading/setting the RD deceleration (braking ramp) as converted value	16 bit – HiByte – time unit 0..255 16 bit – LoByte – increment 0..255

Zone error register (ERR)

Error registers of zones map only the error state of the individual zone in each case, while the error register of the GatewayControl always returns the cumulative error of the entire system.

Bit position	15	14	13	12	11	10	9	8
Acronym	**SYS**	**IPAR**	**---**	**SLRD**	**---**	**GET2**	**---**	**GET1**
Read/Write	R	R	R	R	R	R	R	R
Description	System error	Parameter Error	Not used	Slave RollerDrive Error	Not used	TimeOut2 Error	Not used	TimeOut1 Error
Bit Low	No error	No error	---	No error	---	No error	---	No error
Bit High	Error	Error	---	Error	---	Error	---	Error
Comment	Voltage-, temperature-, RollerDrive- or sensor-error. (Behavior of RD- and sensor-errors can be configured)	Zone has no valid conveying parameters.	---	Slave RollerDrive signals error condition.	---	No sensor signal while transporting the loaded cargo towards the zone exit.	---	No sensor signal while loading the cargo into the zone.

Bit position	7	6	5	4	3	2	1	0
Acronym	---	SENS	---	RD	CON	ML	VO	TMP
Read/Write	R	R	R	R	R	R	R	R
Description	Not used	Sensor Error	Not used	RollerDrive Error	Communi-cation Error	Connection Error	Voltage Error	Temperature Error
Bit Low	---	No error	---	No error	No error	No error	No error	No error
Bit High	---	Error	---	Error	Error	Error	Error	Error
Comment	---	Zone sensor signals error condition.	---	RollerDrive signals error condition.	Faulty transmission on ConveyorControl bus.	No heart beat message from master received.	Supply voltage out of range.	Brake resistor too hot.

Appendix B – Setting Values/Errors – Acyclical Process Data

Extended error register (ERREXT)

The extended error register resolves the system error further. It is being updated for the most recent error in each case.

Bitposition	15-8	7	6	5	4	3	2	1	0
Acronym	**NodeID**	**NETRF**	**NETCF**	**NETU**	**NCE**	**NSC**	**NRB**	**HBL**	**NIE**
Read/Write	R	R	R	R	R	R	R	R	R
Description	ID of faulty module	Transmission cycle failed	Module check at startup failed	Network Unavailable	Communi-cation error	Unexpected communi-cation state	Unexpected module restart	Heart beat lost	Module issued system error
Bit Low		No error	No error	No error	No error	No error	No error	No error	No error
Bit High		Error	Error	Error	Error	Error	Error	Error	Error
Comment	Node ID of the last module which caused a system error.	Module didn't respond to a transmission request on the Conveyor-Control bus.	Module signaled a system error during system initialization.	Health check of Conveyor-Control bus during system initialization failed.	Module signaled a transmission error on the Conveyor-Control bus.	Module is not in the expected communi-cation state.	Module did an unexpected restart.	Module is missing heart beat messages from the master.	Module signaled a system error during normal system operation.

For EtherNet/IP, the extended error register can be read via the adapter object (class attribute 10).

For Profibus/Profinet, the extended error register is transmitted with a diagnostics alarm.

Appendix C – Program Examples

The following code fragments explain the conversion of setting values from physical unit to system-internal representation and vice versa. The examples were created with TIA Portal V11 SP2 STEP 7 Professional for the controllers S7/300 and S7/1200. The supplied USB stick contains corresponding project archives as well as a project for EtherNet/IP with the Allen-Bradley RSLogix 5000 1769-L18ER-BB1B controller.

Conversion instructions for speed

The following code fragments explain the conversion of conveying speed from physical unit m/s to system-internal representation and vice versa.

```
//-Function Header------------------------------------------------------------
// Name:           IR_SpeedToRaw
//
// Parameter:
// Role            Name               Meaning
// In              fSpeed_mls         Target conveying Speed
// In              fGearing           RollerDrive gearing
// In              fDiameter_mm       Roller diameter
// Out             bRawData0          LSB raw data
// Out             bRawData1          MSB raw data
//
// Return:
// Value           Meaning
// -----
//
// Data:
// Name            Meaning
// -----
//
// Error:
// Value           Meaning
// -----
//
// Effect: Converts conveying speed from 'm/s' to internal format.
//
// Construction:
// Converts the conveying speed, given as physical dimension 'm/s', to an
// internal format in the range 0..255 .
// The value '255' correspondents to a motor speed of 6000 rpm.
//
//-----------------------------------------------------------------------------
```

```
FUNCTION "IR_SpeedToRaw" : Void
TITLE = Conveyor Control - SpeedToRaw
{ S7_Optimized_Access := 'FALSE' }
AUTHOR : hhenze
FAMILY : IR_CC
VERSION : 0.1

VAR_INPUT
   "fSpeed_mls"              : Real;          // Conveying Speed
   "fGearing"                : Real;          // RollerDrive gearing
   "fDiameter_mm"            : Real;          // Roller diameter
END_VAR

VAR_OUTPUT
   "bRawData0"               : Byte;          // LSB raw data
   "bRawData1"               : Byte;          // MSB raw data
END_VAR

VAR_TEMP
   "fRawVal"                 : Real;          // Speed as raw value
   "fMotorSpeed_rps"         : Real;          // Motor speed in rotations per second
END_VAR

BEGIN
   // Calculate motor speed in rotations per second
   #fMotorSpeed_rps := (#fSpeed_mls * #fGearing * 1000.0) / (#fDiameter_mm * "cfPi");

   // Convert speed to a value between 0 and 255 (255 means max. 6000 rpm motor Speed)
   // (100.0 is max. speed in rotations per second, 5.0 is minimum rotation speed,
   // 62.0 is the zero motion hold offset, 95.0 is 100.0 - 5.0, 193.0 is 255.0 - 62.0)
   #fRawVal := (((#fMotorSpeed_rps - 5.0) * 193.0) / 95.0) + 62.0;

   // Limit speed to maximal 6000 rpm
   IF (#fRawVal > 255.0) THEN
      #fRawVal := 255.0;
   END_IF;

   // Return raw value
   #bRawData0 := INT_TO_BYTE(REAL_TO_INT(#fRawVal));
   #bRawData1 := 0;
END_FUNCTION
```

```
//-Function Header-----------------------------------------------------------
// Name:           IR_RawToSpeed
//
// Parameter:
// Role            Name               Meaning
// In              aRawData           Speed as raw value
// In              fGearing           RollerDrive gearing
// In              fDiameter_mm       Roller diameter
//
// Return:
// Value           Meaning
// >=0.0           Conveying speed in m/s
//
// Data:
// Name            Meaning
// -----
//
// Error:
// Value           Meaning
// -----
//
// Effect: Converts conveying speed from internal format to 'm/s'.
//
// Construction:
// Converts the conveying speed, given as internal format in the range 0..255,
// to the physical dimension 'm/s' .
// The value '255' correspondents to a motor speed of 6000 rpm.
//
//------------------------------------------------------------------------------

FUNCTION "IR_RawToSpeed" : Real
TITLE = Conveyor Control - RawToSpeed
{ S7_Optimized_Access := 'FALSE' }
AUTHOR : hhenze
FAMILY : IR_CC
VERSION : 0.1

VAR_INPUT
   "aRawData"                  : Array [0..1] of Byte;   // Speed as raw value
   "fGearing"                  : Real;                   // RollerDrive gearing
   "fDiameter_mm"              : Real;                   // Roller diameter
END_VAR

VAR_TEMP
   "fRawVal"                   : Real;                   // Raw value as float
   "fMotorSpeed_rps"           : Real;                   // Motor speed in rotations per second
END_VAR

BEGIN
   // Convert raw value to float
   #fRawVal := INT_TO_REAL(BYTE_TO_INT(#aRawData[0]));

   // Calculate motor speed in rotations per second (255 means max. 6000 rpm motor Speed)
   // (100.0 is max. speed in rotations per second, 5.0 is minimum rotation speed,
   // 62.0 is the zero motion hold offset, 95.0 is 100.0 - 5.0, 193.0 is 255.0 - 62.0)
   #fMotorSpeed_rps := (((#fRawVal - 62.0) * 95.0) / 193.0) + 5.0;

   // Convert raw speed to conveying speed in 'm/s' ('255' raw value means 6000 rpm motor)
   #IR_RawToSpeed := (#fMotorSpeed_rps * #fDiameter_mm * "cfPi") / (#fGearing * 1000.0);
END_FUNCTION
```

Conversion instructions for acceleration

The following code fragments explain the conversion of the acceleration (deceleration= analogous) from physical unit m/s^2 to system-internal representation and vice versa.

```
//-Function Header-----------------------------------------------------------
// Name:           IR_AccelToRaw
//
// Parameter:
// Role            Name               Meaning
// In              fAccel_mls2        Target acceleration
// In              fGearing           RollerDrive gearing
// In              fDiameter_mm       Roller diameter
// Out             bRawData0          LSB raw data
// Out             bRawData1          MSB raw data
//
// Return:
// Value           Meaning
// -----
//
// Data:
// Name            Meaning
// -----
//
// Error:
// Value           Meaning
// -----
//
// Effect: Converts acceleration from 'm/s2' to internal format.
//
// Construction:
// Converts the acceleration, given as physical dimension 'm/s2', to
// an internal format. This is a value pair, comprising speed increment
// per acceleration intervall and the acceleration intervall time.
// Maximum possible motor speed is 6000 rpm and correspondents to a
// speed value of '255'.
//
//------------------------------------------------------------------------------
```

```
FUNCTION "IR_AccelToRaw" : Void
TITLE = Conveyor Control - IR_AccelToRaw
{ S7_Optimized_Access := 'FALSE' }
AUTHOR : hhenze
FAMILY : IR_CC
VERSION : 0.2

VAR_INPUT
   "fAccel_mls2"              : Real;          // Acceleration
   "fGearing"                 : Real;          // RollerDrive gearing
   "fDiameter_mm"             : Real;          // Roller diameter
END_VAR

VAR_OUTPUT
   "bRawData0"                : Byte;          // LSB raw data
   "bRawData1"                : Byte;          // MSB raw data
END_VAR

VAR_TEMP
   "fMaxSpeed_mls"            : Real;          // Maximum possible speed
   "fDeltaSpeed_mls"          : Real;          // Speed increment per accel. intervall
   "fAccelTime_ms"            : Real;          // Acceleration time
   "fIntervallTime_ms"        : Real;          // Acceleration intervall time
   "iRawIncrement"            : Int;           // Raw increment per intervall
   "iRawIntervall"            : Int;           // Raw intervall [10 ms]
END_VAR

BEGIN
   // Check, if maximum acceleration requested (0.0)
   IF (#fAccel_mls2 = 0.0) THEN
      // Set speed increment and time intervall to 'maximum acceleration'
      #iRawIncrement := 0;
      #iRawIntervall := 128;
   ELSE
      // Normal processing:
      // Calculate the maximum possible speed
      #fMaxSpeed_mls := (#fDiameter_mm * "cfPi" * 0.1) / #fGearing;

      // Calculate the acceleration time
      #fAccelTime_ms := (#fMaxSpeed_mls * 1000.0) / #fAccel_mls2;

      // Calculate the acceleration intervall time (20 steps to max. speed)
      #fIntervallTime_ms := #fAccelTime_ms / 20.0;
      #fIntervallTime_ms := DINT_TO_REAL(ROUND(#fIntervallTime_ms / 10.0)) * 10.0;
      IF (#fIntervallTime_ms < 10.0) THEN
         #fIntervallTime_ms := 10.0;
      END_IF;

      // Calculate raw speed increment and raw time intervall
      #iRawIncrement := REAL_TO_INT((193.0 * #fIntervallTime_ms * 8.0
      IF (#iRawIncrement > 255) THEN                                  ) / #fAccelTime_ms);
         #iRawIncrement := 255;
      END_IF;
      #iRawIntervall := REAL_TO_INT(#fIntervallTime_ms / 10.0);
      IF (#iRawIntervall > 255) THEN
         #iRawIntervall := 255;
      END_IF;
   END_IF;

   // Return raw value
   #bRawData0 := INT_TO_BYTE(#iRawIntervall);
   #bRawData1 := INT_TO_BYTE(#iRawIncrement);
END_FUNCTION
```

```
//-Function Header-----------------------------------------------------------
// Name:          IR_RawToAccel
//
// Parameter:
// Role           Name              Meaning
// In             aRawData          Acceleration in internal format
// In             fGearing          RollerDrive gearing
// In             fDiameter_mm      Roller diameter
//
// Return:
// Value          Meaning
// >=0.0          Acceleration in m/s^2
//
// Data:
// Name           Meaning
// -----
//
// Error:
// Value          Meaning
// -----
//
// Effect: Converts acceleration from internal format to 'm/s2'.
//
// Construction:
// Converts the acceleration, given in an internal format (the speed increment per
// acceleration interval and the acceleration intervall time), to the physical
// dimension 'm/s2'.
// Maximum possible motor speed is 6000 rpm and correspondents to a
// speed value of '255'.
//-----------------------------------------------------------------------------

FUNCTION "IR_RawToAccel" : Real
TITLE = Conveyor Control - IR_RawToAccel
{ S7_Optimized_Access := 'FALSE' }
AUTHOR : hhenze
FAMILY : IR_CC
VERSION : 0.2

VAR_INPUT
   "aRawData"                : Array[0..1] of Byte;   // Acceleration in internal format
   "fGearing"                : Real;                  // RollerDrive gearing
   "fDiameter_mm"            : Real;                  // Roller diameter
END_VAR

VAR_TEMP
   "fMaxSpeed_mls"           : Real;                  // Maximum possible speed
   "fIntervalllTime_ms"      : Real;                  // Acceleration intervall time
   "fMaxSpeed_mls"           : Real;                  // Maximum possible speed
   "fIntervallTime_ms"       : Real;                  // Acceleration intervall time
   "fAccelTime_ms"           : Real;                  // Acceleration time
   "iIncrement"              : Int;                   // Raw increment value
   "iIntervall"              : Int;                   // Raw intervall value
END_VAR

BEGIN
   // The raw value is split into a speed increment and an acceleration intervall time.
   #iIntervall := BYTE_TO_INT(#aRawData[0]);
   #iIncrement := BYTE_TO_INT(#aRawData[1]);
   // Check, if 'maximum possible acceleration' configured
   IF (#iIncrement = 0) THEN
      // Return an acceleration value of '0.0'
      #IR_RawToAccel := 0.0;
   ELSE
      // Normal processing:
      // Calculate the maximum possible speed
      #fMaxSpeed_mls := (#fDiameter_mm * "cfPi" * 0.1) / #fGearing;

      // Calculate acceleration time
      #fIntervallTime_ms := INT_TO_REAL(#iIntervall) * 10.0;
      #fAccelTime_ms := (193.0 * #fIntervallTime_ms * 8.0) / INT_TO_REAL(#iIncrement);

      // Calculate the acceleration in m/s2
      #IR_RawToAccel := (#fMaxSpeed_mls * 1000.0) / #fAccelTime_ms;
   END_IF;
END_FUNCTION
```

Appendix D – Slot Assignment for Profibus/ Profinet

The GatewayControl is logically divided into 11 modules that are firmly assigned to the slots described below:

Slot no.	Module name	Description of functions	Data length
1	GSCR & Master Zone IO Data	Global Status / Control Register I/ O data of GatewayControl	2 bytes
2	64 zones of IO data	I/O data of conveying zones 1 - 64	64 bytes
3	64 zones of IO data	I/O data of conveying zones 65 - 128	64 bytes
4	64 zones of IO data	I/O data of conveying zones 129 - 192	64 bytes
5	8 zones of IO data	I/O data of conveying zones 193 - 200	8 bytes
6	STATUS Error Register [R]	Reading the error register asynchronously	Asynchrono us
7	PARAM RD Direction [RW]	Read/write conveying direction	Asynchrono us
8	PARAM RD Speed 1 [RW]	Read/write conveying speed 1	Asynchrono us
9	PARAM RD Speed 21 [RW]	Read/write conveying speed 2	Asynchrono us
10	PARAM RD Ramp Start [RW]	Read/write acceleration	Asynchrono us
11	PARAM RD Ramp Stop [RW]	Read/write deceleration	Asynchrono us

Slots 6 to 11 are used exclusively for addressing the asynchronous data. The data stored in the I/O area of the control have no meaning.

Appendix E – CIP Objects for EtherNet/IP

Identity Object

This object is used for device identification. The following information applies to the device description object of EtherNet/IP GatewayControl.

Class code	0x01
Class attributes	1, 2, 6, 7
Instances	1
Instance attributes	1, 2, 3, 4, 5, 6, 7, 8, 9

Class attributes of Identity Object

ID	Access	Designation	Data type	Data value
1	Read	Class revision	UINT	1
2	Read	Read maximum number of instances	UINT	1
6	Read	Read highest class attribute	UINT	7
7	Read	Read highest instance attribute	UINT	10

Access methods: Get_Attribute_All, Get_Attribute_Single

Instance attributes of Identity Object

ID	Access	Designation	Data type	Data value
1	Read	Manufacturer ID	UINT	0x0275
2	Read	Device type	UINT	0x000C
3	Read	Product code	UINT	0x0001
4	Read	Revision ID	STRUCT	
		Main number	USINT	1
		Secondary number	USINT	1
5	Read	Device status	WORD	See CIP Standard, Vol. 1
6	Read	Device serial number	UDINT	Device-dependent
7	Read	Product name	STRING	"GatewayControl EtherNet/IP"
8	Read	Device status	USINT	See CIP Standard, Vol. 1
9	Read	Configuration status	UINT	See CIP Standard, Vol. 1
10	Read	Heartbeat interval (Get_Attribute_All only)	USINT	See CIP Standard, Vol. 1

Access methods: Get_Attribute_All, Get_Attribute_Single

Assembly object

This object allows exchanging cyclical useful data. The following information applies to the device description object of EtherNet/IP GatewayControl.

Class code	0x04
Class attributes	1, 2
Instances	1
Instance attributes	3, 4

Class attributes of assembly object

ID	Access	Designation	Data type	Data value
1	Read	Class revision	UINT	1
2	Read	Maximum number of instances	UINT	X

Access methods: Get_Attribute_Single

Instance attributes of assembly object

ID	Access	Designation	Data type	Data value
3	Read/ set	Data	BYTE[]	*see "Appendix A – PLC Process Map – Cyclical Data", page 29*
4	Read	Data length	UINT	202

Access methods: Get_Attribute_Single, Set_Attribute_Single

Connection manager object

This object indicates the connection options to the adapter and configures them. The following information applies to the connection manager object of EtherNet/IP GatewayControl.

Class code	0x06
Class attributes	1, 2
Instances	0
Instance attributes	

Class attributes of connection manager object

ID	Access	Designation	Data type	Data value
1	Read	Class revision	UINT	1
2	Read	Maximum number of instances	UINT	1

Access methods: Get_Attribute_Single

Adapter object

This object is device-specific and establishes the interface to the device functionality. It serves as configuration and monitoring interface to an EtherNet/IP scanner. Expanded diagnostics are kept here and access to parameter data is made possible. The following information applies to the application object of EtherNet/IP GatewayControl.

Class code	0x64
Class attributes	1, 2, 3, 6, 7, 8, 9, 10
Instances	200 (1...200 = zone number)
Instance attributes	6, 7, 8, 9, 10, 11
Services	Get_Attribute_Single, Set_Attribute_Single

Class attributes of adapter object

ID	Access	Designation	Data type	Data value
1	Read	Class revision	UINT	1
2	Read	Highest instance number	UINT	200
3	Read	Number of generated instances	UINT	200
6	Read	Highest class attribute	UINT	10
7	Read	Highest instance attribute	UINT	11
8	Read/ set	Read/set GSCR	USINT	see Description of functions
9	Read	System-wide error tab	UINT	see Description of functions
10	Read	System-wide expanded error tab	UINT	see Description of functions

Access methods: Get_Attribute_Single, Set_Attribute_Single

Instance attributes of adapter object

ID	Access	Designation	Data type	Data value
6	Read	Zone error tab	UINT	see Description of functions
7	Read/ set	RollerDrive direction of rotation	UINT	see Description of functions
8	Read/ set	RollerDrive speed	UINT	see Description of functions
9	Read/ set	RollerDrive alternate speed	UINT	see Description of functions
10	Read/ set	RollerDrive acceleration value	UINT	see Description of functions
11	Read/ set	RollerDrive braking value	UINT	see Description of functions

Access methods: Get_Attribute_Single, Set_Attribute_Single

TCP/IP interface object

This object is used for configuring the TCP/IP interface. The following information applies to the TCP/IP object of EtherNet/IP GatewayControl.

Class code	0xF5
Class attributes	1, 2
Instances	1
Instance attributes	1, 2, 3, 4, 5, 6, 10

Class attributes of TCP/IP interface object

1 Read UINT 2 2 Read UINT 1

ID	Access	Designation	Data type	Data value
1	Read	Class revision	UINT	2
2	Read	Maximum number of instances	UINT	1

Access methods: Get_Attribute_Single

Instance attributes of TCP/IP interface object

ID	Access	Designation	Data type	Data value
1	Read	Status attributes	DWORD	See CIP Standard, Vol. 2
2	Read	Configuration attributes	DWORD	0x00000095
3	Read/ set	Configuration control attributes	DWORD	0x00000000
4	Read	Physical connection object	STRUCT	
		Path length (in 16-bit words)	UINT	0x0002
		Path	EPATH	20 F6 24 01
5	Read/ set	Interface configuration	STRUCT	
		IP address	UDINT	xxx.xxx.xxx.xxx
		Network mask	UDINT	xxx.xxx.xxx.xxx
		Gateway address	UDINT	xxx.xxx.xxx.xxx
		Address of prim. name server	UDINT	xxx.xxx.xxx.xxx
		Address of sec. name server	UDINT	xxx.xxx.xxx.xxx
		Domain name	STRING	""
6	Read/ set	Host name	STRING	"gateway"
10	Read/ set	ACD status	USINT	1

ID	Access	Designation	Data type	Data value
11	Read/ set	Last ACD conflict	STRUCT	
		ACD activity	USINT	0
		Remote MAC	USINT[6]	XX:XX:XX:XX:XX:XX
		Copy of ARP PDU	USINT[28]	0

Access methods: Get_Attribute_All, Get_Attribute_Single, Set_Attribute_Single

EtherNet link object

Connection-specific status and counter information. The following information applies to the EtherNet link object of EtherNet/IP GatewayControl.

Class code	0xF6
Class attributes	1, 2, 3
Instances	1, 2
Instance attributes	1, 2, 3, 6, 10

Class attributes of EtherNet link object

1 Read UINT 3 2 Read UINT 2 3 UINT 1,2

ID	Access	Designation	Data type	Data value
1	Read	Class revision	UINT	3
2	Read	Maximum number of instances	UINT	2
3	Read	Read number of existing instances	UINT	1, 2

Access methods: Get_Attribute_Single

Instance attributes of EtherNet link object

ID	Access	Designation	Data type	Data value
1	Read	Interface speed	UDINT	0x00000064
2	Read	Interface flags	DWORD	0x0000002F
3	Read	Physical MAC address	USINT[6]	00:02:A2:XX:XX:XX
6	Read/ set	Interface control	STRUCT	
		Control bits	WORD	0x0001
		Required interface speed	UINT	0x0000
10	Read	Interface label	STRING	"port1"

Access methods: Get_Attribute_All, Get_Attribute_Single, Set_Attribute_Single

Appendix F – Electrical Data of Connections

Connection	Pin	Nominal value	Area of	Comment
Power		+24 V	19 to 26 V DC	Harmonic-free DC voltage Current consumption: permanent 3 A_{eff}, max. peak current 5.5 A @ 500 ms, repetition rate 1 Hz
		GND	0	Functional earthing permitted, negative voltage not permitted
Data				Bus communication, connection of non-system voltages and loads not permitted
USB		USB 2.0		Only permitted for use as a data interface

Appendix G – Glossary of Parameters

PB1 *BusType*: A GatewayControl was selected via the *Map* step. PB1 designates the fieldbus selected with it. The parameter value cannot be changed.

PB2 *BusBitrate*: Transfer speed of Profibus (Profibus only).

Default is *Autodetect*.

PB3 *BusAddress*: The GatewayControl is a Profibus node. The Profibus node address intended for the GatewayControl Profibus must be entered here.

Default is *5*.

PB4 *HostName*: Name of the GatewayControl in the network (Profinet, EtherNet/IP).

Default is *Gateway*.

This name must match the name specified in the PLC.

PB5 *IPAddress*: Internet protocol address of the GatewayControl in the network (Profinet, EtherNet/IP).

Default is *0.0.0.0*.

PB6 *SubnetMask*: Definition of the relevant bits for the network prefix of the Internet protocol address (Profinet, EtherNet/IP).

Default is *0.0.0.0*.

PB7 *BroadcastAddress*: Broadcast address of the GatewayControl in the Internet protocol subnet (Profinet, EtherNet/IP).

Default is *0.0.0.0*.

PB8 *BusErrorResponse*: Response of the system in case of transmission interruptions on the fieldbus or faults in the PLC (Profibus, Profinet, EtherNet/IP).

- *LED display*: Conveyor remains in operating state. The error is indicated via fault LED. The LED fault display is automatically reset once the fault has been removed.
- *System stops*: Conveyor is being stopped. The error is indicated via fault LED. The LED fault display is automatically reset and the system automatically returns to operation once the fault has been removed.
- *System error*: Conveyor is being stopped and changes to the *System error* state. The error is indicated via fault LED. The system error can be reset only via voltage reset.

Default is *System stops*.

PB10 *DomainName*: Domain name of the GatewayControl in the Internet Domain Name System (DNS) (EtherNet/IP only).

Default: ""

PB11 *DNS ServerAddress*: IP address of the primary DNS server responsible for the name resolution (EtherNet/IP only).

Default is *0.0.0.0*

PB12 *DNS ServerAddress2*: IP address of the alternate DNS server responsible for the name resolution (EtherNet/IP only).

Default is *0.0.0.0*

PB13 *NetworkConfigMode*: Procedure for the network settings (EtherNet/IP only).

- *Static*: Settings are made via the Configurator (PB4, PB5, PB6, PB7, PB10, PB11, PB12)
- *BOOTP*: Settings are made via network using a BOOTP server (PB4, PB5, PB6, PB7, PB10, PB11, PB12)
- *DHCP*: Settings are made via network using a DHCP server (PB4, PB5, PB6, PB7, PB10, PB11, PB12)

Default is *DHCP*

PB14 *Port setting*: Operating mode and transfer speed of the Ethernet port (EtherNet/IP only).

- *HalfDuplex 10 Mbps*: Half-duplex transmission with 10 Megabit per second
- *FullDuplex 10 Mbps*: Full-duplex transmission with 10 Megabit per second
- *HalfDuplex 100 Mbps*: Half-duplex transmission with 100 Megabit per second
- *FullDuplex 100 Mbps*: Full-duplex transmission with 100 Megabit per second
- *Auto*: Automatic configuration of Ethernet port

Default is *Auto*

PG1 *ControlMode*: Control operating mode of the ConveyorControl system (Profibus, Profinet, EtherNet/IP).

- *I/O PLC control*: The control of the conveyor process is done decentrally in the ConveyorControl modules. The PLC can monitor errors and the conveyor process and affect it by setting global or zone-based control signals (signals correspond to the selection under PIN4)
- *Complete PLC control*: Control is done exclusively via PLC; for this purpose, it receives the status messages of sensors and RollerDrive. The ConveyorControl modules serve only as decentral I/O module.

Default is *I/O PLC control*.

ProductKey If the Configurator is connected with the ConveyorControl, the Interroll article number is displayed for the selected module.

Serial If the Configurator is connected with the ConveyorControl, the Interroll serial number is displayed for the selected module.

MACAddress Ethernet hardware address of GatewayControl (read value only). The address is displayed only if a USB connection exists to the GatewayControl and the ConveyorControl modules have been addressed.

Appendix H – Installation Declaration

Installation declaration

in accordance with the EC Machinery Directive 2006/42/EC, Appendix II B

The manufacturer:

Interroll Engineering GmbH
Hoeferhof 16
D - 42929 Wermelskirchen
Germany

hereby declares with sole responsibility that the product range

- GatewayControl

is not a ready-to-use machine as defined by the EC Machinery Directive and, therefore, does not fully comply with the requirements of this directive. The commissioning of these conveyor modules is not permitted unless conformity of the entire machine/system in which they are installed has been declared in compliance with the EC Machinery Directive.

The health and safety requirements as stated in Appendix I have been applied. The special technical documents mentioned in Appendix VII B have been prepared and will be sent to the responsible authority if necessary.

Person authorized to prepare the technical documents:
Interroll Engineering GmbH, Hoeferhof 16, D - 42929 Wermelskirchen

Applicable EC directives:
- Machinery Directive 2006/42/EC
- EMC Directive 2004/108/EC
- RoHS Directive 2002/95/EC

Applicable harmonized standards:
- EN ISO 12100-03 "Safety of machinery - Basic concepts - risk assessment and reduction"

Wermelskirchen, 31 September 2013

Armin Lindholm

(Managing Director)

(This declaration can be obtained at www.interroll.com, if needed.)

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Translation of the original instructions

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interroll.com/contacts